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Management of brinjal seed mycoflora through fungicides *in vitro*

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Abstract
Fungal infection on the seed adversely affects the seed quality, causing seed discoloration, reduced seed weight and density, poor germinability and reduced viability. Seed mycofora load on five cultivars of brinjal *viz.*, GOB-1, Doli-5, GAOB-2, GABH-3 and ABH-1 was studied and *Alternaria tenuis, Fusarium oxysporum, Aspergillus niger, A. flavus, Curvularia lunata, Penicillium* sp. and *Phoma* sp. were found associated with seeds. Among all cultivar GOB-1 had highest number of seed mycoflora. Seed treatment of systemic and non-systemic fungicides of the cultivar GOB-1 seeds with carbendazim, tricyclazole, tebuconazole, thiram, captan and mancozeb at their respective concentrations revealed significant differences in per cent seed mycoflora. All the treatments reduced the seed mycoflora but none of the treatments gave complete control of all fungi. However, minimum number of fungal species (three) were recorded with thiram at 0.3 per cent with minimum per cent seed mycoflora (6.25%) followed by carbendazim at 0.1 per cent and tebuconazole at 0.1 per cent. Among all the fungicides, highest per cent seed mycoflora was observed with mancozeb at 0.3 per cent.

Keywords: Seed mycoflora, fungicides, seed discoloration, seed treatment and viability

Introduction
Brinjal (*Solanum melongena* L.) is a widely grown vegetable crop in Asian countries. Brinjal is infected by a number of diseases, caused by fungal species which adversely affect on the yield and the quality. Seed-borne diseases caused by fungi are relatively difficult to control, as the fungal hyphae get established and become dormant (Butt *et al.,* 2011) [1]. Seed infection adversely affects the seed quality, causing seed discoloration, reduced seed weight and density, poor germinability and reduced viability (Toole *et al.,* 1941; Vishunavat and Kumar, 1993) [9, 10]. Neergaard (1977) [7] reported fungi associated with the seed samples of brinjal which were identified as *A. alternata, F. solani, F. oxysporum, A. flavus, C. lunata* and some non-pathogenic species of *Penicillium, Mucor* and *Epicoccum* spp. *A. alternata, F. solani, F. oxysporum* and *C. lunata* were serious pathogenic fungi causing quantitative and qualitative losses to different seeds during storage. Patekar (2017) [8] studied seed-borne pathogens of brinjal using blotter paper method and observed *A. flavus, A. niger, Fusarium* spp., *Rhizopus* spp. and *Cladosporium* spp. Kassim and Monawar (2000) treated the five vegetable seeds including tomato, eggplant, okra etc. in Gazan province with fungicides *viz.*, benomyl, cozib and mancozeb @ 0.2%, before incubation. All tested fungicides showed inhibitory effect on most of the isolated fungi. Islam and Meah (2011) [4] reported that seed treatment with bavistin at @ 0.1 % and Vitavax–200 @ 0.2% were found effective against *P. vexans* in brinjal. Seed treatment was more economical and effective when it is carried out with respect to nature of pathogen and level of infection percentage (Neergaard, 1974) [6]. Primary step in any agricultural crop production and protection programme is control of seed-borne pathogens through various methods. Therefore, substantial control of seed-borne pathogens can be achieved by using chemical methods. The objective of the present study was to evaluate the efficiency of different systemic and non-systemic seed dressing fungicides to bring down the seed-borne inoculums.

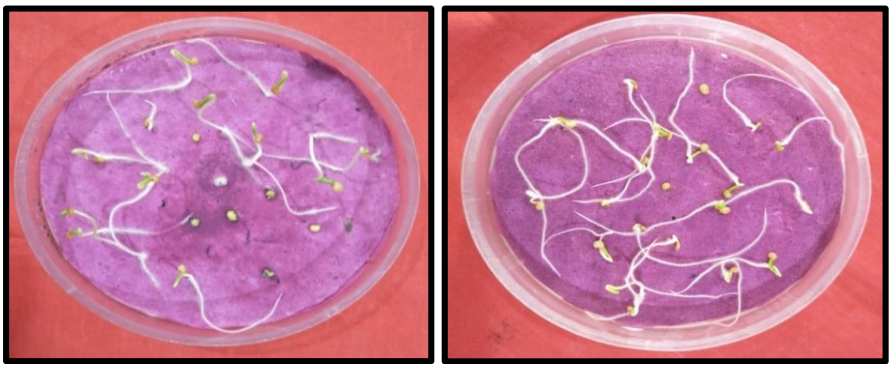
Materials and methods
In vitro evaluation of fungicides for the management of seed mycoflora of brinjal was carried out by standard blotter method at department of plant pathology, B. A. College of agriculture, Anand Agricultural University, Anand durig 2018 against cultivar GOB-1. Seven fungi *viz., A. tenuis, F. oxysporum, A. niger, A. flavus, C. lunata, Penicillium* sp. and *Phoma* sp. were associated with the cultivar GOB-1.

The experiment was carried out in completely randomized design with three systemic fungicides *viz.*, carbendazim @ 0.1%, tricyclazole @ 0.1%, tebuconazole @ 0.1% and three non-systemic fungicides *viz.*, thiram @ 0.3%, captan @ 0.3% and mancozeb @ 0.3% with four repetitions each. Seeds of cultivar GOB-1 were treated with the six fungicides and one untreated control. For evaluating seed dressing fungicides, treated seeds were plated in blotter plate (20 seeds/plate) having three layers of moist blotting papers. Seeds plated without fungicidal treatment was kept as check.

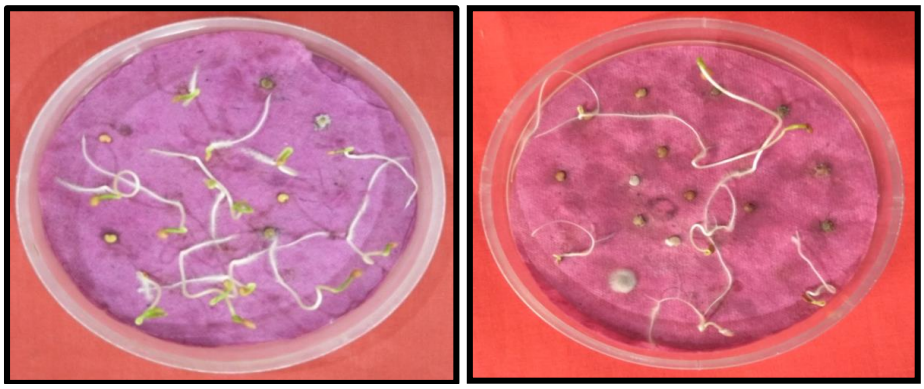
Result and Discussion

Evaluation of six fungicides among which three systemic *viz.* carbendazim, tricyclazole, tebuconazole and three non-systemic *viz.*, thiram, captan and mancozeb as seed treatment of brinjal cultivar (GOB-1) at their respective concentrations against seed mycoflora revealed significant differences in per cent seeds mycoflora (Table 1). All the treatments of fungicides reduced the seed mycoflora but none of the treatments gave complete control of all fungi. However, minimum number of fungal species (three) were recorded with thiram @ 0.3 per cent and minimum per cent seed mycoflora 6.25% followed by carbendazim @ 0.1 per cent and tebuconazole @ 0.1 per cent. Better performance of carbendazim can be attributed due to their systemic nature. Minimum per cent seed mycoflora was observed with thiram @ 0.3 *viz., A. tenuis, A. flavus, A. niger, C. lunata* and *Phoma* sp. while, *F. oxysporum*, *Penicillium* sp. and *Phoma* sp. were recorded minimum with carbendazin @ 0.1%.This research work was supported by Hossain *et al.* (2013) who reported that thiram, captan, carbendazim etc. were found effective in controlling *P. vexans*. Carbendazim at 0.1% completely inhibited the mycelial growth of *P. vexans*. Habib (2007) reported that benlate gave maximum seed germination (91%) in *F. solani* treated pots of brinjal whereas, captan gave maximum seed germination (81%) against the *A. alternata*. All three fungicides *i.e.*, benlate, topsin-M and captan proved effective in inhibiting the fungal colony by 49.39%, 86.20% and 88.50% of *F. solani* and 81.31%, 61.53% and 50.54% of *A. alternata*, respectively.

Tricyclazole 75 WP | Tebuconazole 2 DS | Mencozeb 75 WP



Captan 75 WP | Carbendazim 50 WP



Thiram 75 WS | Control

Plate 1: Effect of different fungicides on seed mycoflora of brinjal

Table 1: Per cent seed mycoflora of brinjal against fungicidal seed treatment

Sr. no.	Treatment	Conc. (%)	Per cent seed showing mycoflora								
			Fusarium oxysporum	*Phoma* sp.	*Penicillium* sp.	*Curvularia lunata*	*Alternaria tenuis*	*Aspergillus flavus*	*Aspergillus niger*	Total fungal species observed	Total (%)
1.	Carbendazim 50 WP	0.1%	0.00	0.00	0.00	2.25	3.25	2.25	2.25	4	10.00
2.	Tricyclazole 75 WP	0.1%	0.75	4.75	3.25	4.75	4.25	5.25	3.25	7	26.25
3.	Tebuconazole 2 DS	0.1%	1.00	4.25	2.00	3.25	6.25	4.25	4.25	7	25.25
4.	Thiram 75 WS	0.3%	3.25	0.00	2.25	0.00	0.00	0.75	0.00	3	6.25
5.	Captan 75 WP	0.3%	5.00	5.25	6.00	2.00	2.25	4.25	5.75	7	30.50
6.	Mancozeb 75 WP	0.3%	4.25	6.25	2.75	6.25	6.25	5.25	3.25	7	34.25
7.	Control	-	10.25	10.25	12.50	9.25	10.25	13.25	13.25	7	79.00
	S. Em. ±		0.19	0.21	0.20	0.21	0.23	0.25	0.23		
	C. D. at 5 %		0.56	0.62	0.58	0.62	0.68	0.74	0.68		
	C. V. %		10.80	9.62	9.58	10.66	9.97	9.93	10.13		

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